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150-Page
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...the **NEW** Science Fair[®] story of **ELECTRONICS**

America is unique in the history of mankind. It is a relative of the world . . . a land built by immigrants and descendants of immigrants united in their efforts to achieve a better way of life, and united in their desire to share these benefits with people in other countries.

From America came Samuel Morse and his telegraph; Alexander Graham Bell and his telephone; Thomas Edison and his incandescent lamp; Nikola Tesla and his alternating current power generators and motors, which gave us efficient electric power for industry and home use; Charles Steinmetz the mathematical genius and his contributions to electrical engineering technology; Almon Brown Strowger, inventor of the dial telephone; Lee deForest and his three-element radio tube which first made possible the amplification of radio and long distance telephone signals; Joseph Tykocinski-Tykociner who gave the world's first public demonstration of sound-on-film movies on June 9, 1922, at the University of Illinois; Vladimir Zworykin and his all-electronic television picture transmitting and receiving system; Karl Jansky and his discovery of radio waves from outer space—the beginning of radio astronomy; Lauren Hammond and his electric organ; Ernst Alexanderson and his famous alternator used in wireless telegraphy and his pioneer work with radio altimeters and facsimile; Joseph Henry, first secretary of the Smithsonian Institution and his discoveries in electromagnetism; Michael Idvorsky Pupin, his famed "Pupin coil" used in long distance telephone communication, and his work with X-rays; the co-invention of the transistor by William Shockley, Walter Brattain and John Bardeen, which paved the way for tiny lightweight electronic circuits found in today's solid state radios, stereos, television sets and computers. These are but a few of the contributions to electronic technology by American scientists.

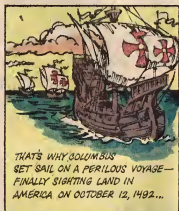
From America came the miracle of color television; the Telstar satellites which have made possible world-wide radio and television reception; and in 1969, American Astronauts Neil Armstrong and Edwin Aldrin were first to land a spacecraft on the Moon from where they talked by radio and television with the President of the United States.

It is the purpose of the *Science Fair Story of Electronics* to rekindle the national pride of our young people—to increase their awareness of America's heritage of individual and business freedom, which in a little over 200 years built our country from a tiny "developing nation" to the world's most advanced industrial nation.

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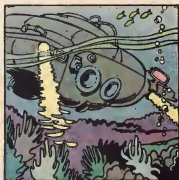
Fall-Winter 1979, Spring 1980 edition of the *New Science Fair Story of Electronics*—the Discovery that Changed the World. William M. Palmer, Editor. Published by the Radio Shack Division of Tandy Corporation, One Tandy Center, Fort Worth, Texas 76102, U.S.A. Copyright© 1979 by Tandy Corporation, One Tandy Center, Fort Worth, Texas 76102, U.S.A. All rights reserved. Narrative by William M. Palmer, illustrations by J & R Weathers, Designers. First printing July, 1979. Printed in the U.S.A. Nothing may be reprinted in whole or in part without written permission from the publisher.

THE STORY YOU ARE ABOUT TO READ BEGAN MANY CENTURIES AGO IN THE CURIOSITY OF OUR ANCESTORS WHO DISCOVERED MANY WAYS TO IMPROVE THE WAY THEY LIVED FROM OBSERVATION AND BY EXPLORATION OF THE UNKNOWN AREAS OF EARTH AND SCIENCE.





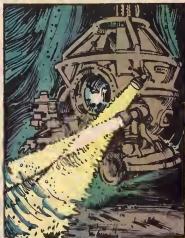
IN 1925, ADMIRAL MACMILLAN'S EXPEDITION TO THE ARCTIC SHOWED HOW **SHORTWAVE** RADIO COULD BE USED TO COMMUNICATE OVER GREAT DISTANCES EVEN IN ARCTIC WEATHER.



TODAY, SCIENCE EXPLORERS WITH THE AID OF ELECTRONICS ARE ALSO SEARCHING THE OCEAN FLOOR FOR NEW REBOURCES AND WAYS TO RETRIEVE THEM.



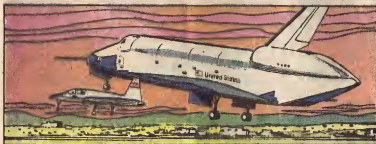
IN MODERN TIMES, AN AMERICAN VIKING - A **ROBOT EXPLORER** - TOUCHED DOWN ON THE PLANET MARS, 400 MILLION MILES FROM EARTH, JULY 20, 1976.



IN 1979, A U.S.-BUILT DEEP WATER CRAFT, ATMOSPHERIC ROVING MANIPULATOR SYSTEM (**ARMS-1**), SET A WORLD'S DEPTH RECORD FOR A DIVING BELL WHEN IT INSPECTED AN OIL WELL-HEAD 2,842 FEET.

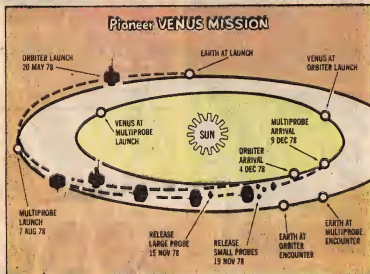
THAT'S WHY AMERICAN SPACE EXPLORERS NEIL ARMSTRONG AND EDWIN ALDRIN SET THEIR SPACE SHIP DOWN ON THE MOON'S SEA OF TRANQUILITY IN 1969 — THEN TALKED FROM THERE BY RADIO AND TELEVISION, WITH A U.S. PRESIDENT IN WASHINGTON, D.C.

THEIR SPACE VOYAGE WAS A STEPPINGSTONE FOR OTHER EXPLORERS WHO WILL TRAVEL EVEN DEEPER INTO OUTER SPACE.



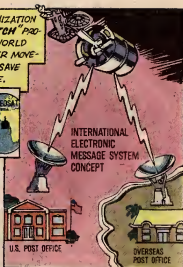
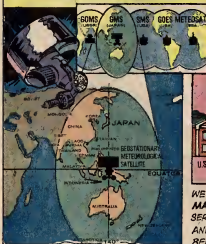
AMERICA'S NEW SPACE SHUTTLE ORBITER "ENTERPRISE" LANDS LIKE AN AIRPLANE AFTER RETURNING FROM ORBIT AROUND THE EARTH, USING A MICROWAVE LANDING SYSTEM — MUCH BETTER THAN THE OLD "PARACHUTE LANDING" OF A CREW CAPSULE IN THE OCEAN.

AMERICA'S SPACE EXPLORATION IS JUST AS IMPORTANT AS THE VOYAGE OF COLUMBUS IN 1492. THE DISCOVERIES THAT OUR EXPLORERS MAKE NOW ARE SURE TO BENEFIT IN MANY WAYS FUTURE GENERATIONS OF MANKIND.

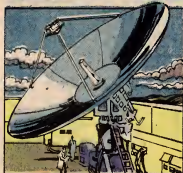


THE U.S.-BUILT PIONEER **VENUS** SPACECRAFT WAS THE FIRST PROJECT WITH THE MAIN PURPOSE OF STUDYING THE ATMOSPHERE AND WEATHER OF ANOTHER PLANET. ITS FINDINGS MAY HELP SCIENTISTS LEARN MORE ABOUT THE FORCES THAT AFFECT EARTH'S WEATHER.

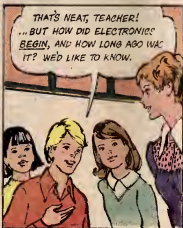
THE WORLD METEOROLOGICAL ORGANIZATION NOW HAS A "WORLD WEATHER WATCH" PROGRAM TO KEEP PEOPLE AROUND THE WORLD INFORMED ABOUT STORM AND WEATHER MOVEMENTS. EARLY STORM WARNINGS CAN SAVE LIVES AND REDUCE PROPERTY DAMAGE.



WE MAY SOON HAVE OVERSEAS SATELLITE MAIL, USING AIR ELECTRONIC MESSAGE SERVICE BETWEEN THE UNITED STATES AND OVERSEAS LOCATIONS — ANOTHER BENEFIT OF OUR SATELLITE AND SPACE EXPLORATION PROGRAM.



MOBILE SATELLITE GROUND STATIONS SENDING ELECTRONIC SIGNALS TO SATELLITES ABOVE THE EARTH LET US SEE WORLDWIDE EVENTS LIKE THE OLYMPIC GAMES ON COLOR TELEVISION... AND NEWS AND CULTURAL PROGRAMS.





AS EARLY AS 600 B.C., THALES OF MILETUS, GREECE, THEORIZED A CONNECTION BETWEEN ELECTRICITY AND MAGNETISM. THE ANCIENTS EVEN TRIED ELECTRIC SHOCKS FROM EELS AS A TREATMENT FOR RHEUMATIC DISEASES.



THAT'S RIGHT! AND WHILE WE DON'T KNOW FOR SURE, IT MIGHT HAVE BEGUN LIKE THIS—



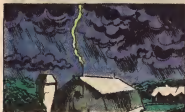
ARCHAEOLOGISTS THINK THAT CRUDE BATTERIES UNEARTHED IN IRAQ IN 1936 WERE USED IN THE ELECTROPLATING OF GOLD, SILVER, AND ANTIMONY AS EARLY AS 227 B.C.



IN 1600 A.D., GILBERT PUBLISHED THE FIRST SCIENTIFIC STUDY OF ELECTRICITY AND MAGNETISM, CALLED "DE MAGNETE."



HE LEARNED IT WAS, AND THEN DEvised HIS LIGHTNING ROD SYSTEM TO GROUND DAMAGING ELECTRIC CHARGES — USED ON HOMES AND OTHER BUILDINGS TO THIS DAY.



AN IMPROVED BATTERY DESIGN WAS MADE BY ALESSANDRO VOLTA IN 1800. OTHER INVENTORS MADE IMPROVEMENTS LATER.



BENJAMIN FRANKLIN SET OUT TO DISCOVER IF NATURAL LIGHTNING WAS THE SAME STUFF AS ELECTRICITY IN HIS FAMOUS KITE AND WIRE EXPERIMENT

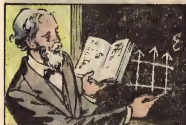


FRANKLIN ALSO ORIGINATED THE "PLUS" AND "MINUS" SIGNS WE USE TO INDICATE ELECTRICAL POLARITY. YOU'LL SEE THESE SIGNS ON FLASHLIGHT BATTERIES.



LATER, FARADAY DEVISED THE FIRST MACHINE TO MAKE ELECTRICITY FROM MECHANICAL ENERGY. IT WASN'T VERY EFFICIENT ... BUT IT WORKED!

ABOUT THIS TIME, MAXWELL WAS STUDYING THE WORKS OF FARADAY, DAVY, AND OTHERS. HIS MATHEMATICS PREDICTED "ELECTROMAGNETIC DISTURBANCES" IN SPACE...



...HERTZ FOUND A WAY TO CREATE THE "DISTURBANCES" STUDIED BY MAXWELL, AND SHOWED THEY BEHAVED IN THE SAME WAY AS LIGHT! IT WAS THE BEGINNING OF "WIRELESS" (RADIO).



GEE! AN AWFUL LOT OF PEOPLE MUST HAVE STUDIED ELECTRICITY BEFORE ANYBODY COULD ACTUALLY USE IT!

YES, AND THEIR NAMES ARE STILL WITH US. THE "GILBERT" IS A UNIT OF MAGNETISM.



OTHER COMMON ONES ARE: OHM, FARAD, AMPERE, AND HENRY...

FOR JOSEPH HENRY, WHO ALSO BUILT THE FIRST ELECTROMAGNET, LATER USED FOR THE DIRECT CURRENT MOTOR.

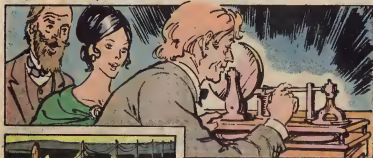


THE ORIGINAL SMITHSONIAN BUILDINGS - 1846



IN 1846, JOSEPH HENRY, INVENTOR AND TEACHER, BECAME THE FIRST SECRETARY OF THE SMITHSONIAN INSTITUTION IN WASHINGTON, D.C. THE SMITHSONIAN WAS ESTABLISHED FROM A GIFT TO THE AMERICAN PEOPLE BY JAMES SMITHSON OF SCOTLAND.

IN 1837, AT THE AGE OF 44, **SAMUEL MORSE**, A PORTRAIT ARTIST, BUILT THE FIRST PRACTICAL TELEGRAPH SOUNDER. THE FIRST TELEGRAM, "WHAT HATH GOD WROUGHT," WAS SENT FROM BALTIMORE IN 1844.



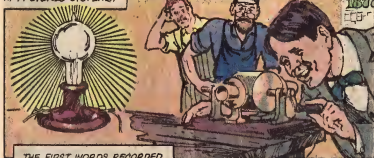
HIS WIRE TELEGRAPH WAS THE FIRST PRACTICAL LONG-RANGE COMMUNICATIONS SYSTEM. IN 1861, **STEPHEN FIELD** SENT THE FIRST TRANSCONTINENTAL TELEGRAPH MESSAGE TO PRES. LINCOLN...

...FROM SAN FRANCISCO, CALIFORNIA TO WASHINGTON, D.C. AND THE YOUNG TELEGRAPH SYSTEM GOT ITS BAPTISM OF FIRE DURING THE U.S. CIVIL WAR WHICH BEGAN THAT YEAR.



IN JULY, 1861, U.S. GEN. **MCCLELLAN** CLAIMED FIRST USE OF THE TELEGRAPH UNDER ACTUAL BATTLE CONDITIONS. ALSO USED LATER DURING AMERICA'S CIVIL WAR WAS THE **TELEGRAPH PRINTER**, INVENTED BY ROYAL HOUSE OF VERMONT. IT USHERED IN A NEW ERA IN RAPID COMMUNICATIONS.

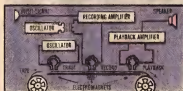
THOMAS EDISON IS BEST REMEMBERED FOR HIS INVENTION OF THE ELECTRIC LIGHT BULB, BUT JUST AS GREAT WAS HIS PHONOGRAPH FOR SOUND RECORDING AND PLAYBACK.... FORERUNNER OF TODAY'S HI-FI STEREO SYSTEMS!



THE FIRST WORDS RECORDED ... AND PLAYED BACK... ON EDISON'S TIN-FOIL RECORD CAME FROM A NURSERY SONG.



A HUNDRED YEARS AFTER THE FIRST PHONOGRAPH, SYSTEMS LIKE THIS CAN RECORD AND PLAY BACK LIFELIKE MUSIC ON A TAPE, ON RECORDS, OR PLAY AM/FM MUSIC OVER ITS RADIO.

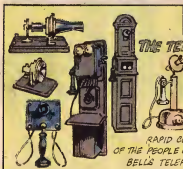


MAGNETIC RECORDING WAS INVENTED BY VALDEMAR POULSEN IN 1899. TAPE RECORDING WAS DEVELOPED IN THE LATE 1930'S. THIS DIAGRAM SHOWS HOW TAPE IS RECORDED.



TODAY, TINY POCKET-SIZE RECORDERS ARE THE THING FOR DICTATION, FOR RECORDING MEETING OR LECTURE NOTES, LANGUAGE STUDY OR FOR RECORDING THE SOUNDS OF A VACATION TRIP.

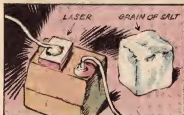
BELL'S FIRST TELEPHONE PATENT WAS ISSUED MARCH 7, 1876, JUST THREE DAYS LATER, ON THE TOP FLOOR OF A BOARDINGHOUSE AT NO. 5 EXETER PLACE, BOSTON, MASSACHUSETTS, THE TELEPHONE CARRIED ITS FIRST VOICE SOUND...



THE TELEPHONES OF YESTERDAY... AND TODAY!

RAPID COMMUNICATIONS HAS MADE NEIGHBORS OF THE PEOPLE OF THE WORLD, AND ALEXANDER GRAHAM BELL'S TELEPHONE HAS PLAYED A MAJOR ROLE.

SOON MANY TELEPHONES WILL HAVE A "PICTURE PHONE" SO YOU CAN SEE AS WELL AS HEAR THE PERSON YOU'RE TALKING TO.

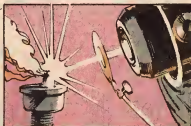


SMALLER THAN A GRAIN OF SALT, THIS SOLID-STATE LASER (ARROW) MAKING A LIGHT THROUGH TINY GLASS FIBERS WILL MAKE IT POSSIBLE TO "TALK BY TELEPHONE OVER A BEAM OF LIGHT." ANOTHER MIRACLE OF SCIENCE!

CAN A LASER DO
OTHER THINGS, TOO?

YES, SCIENTISTS
ARE STILL FINDING
NEW WAYS TO USE
THE LASER.

A LASER CAN FOCUS ENORMOUS ENERGY
ON A VERY SMALL AREA TO CUT STEEL
OR BURN HOLES IN DIAMOND WIRE DIES.



BECAUSE IT CAN BE
CONTROLLED WITH GREAT
ACCURACY, THE LASER IS
USED IN BOTH EYE AND
BRAIN SURGERY.



PRECISION LASER RANGE-FINDERS HELP
THE ARMY PINPOINT TARGETS FOR LASER-
GUIDED MISSILES, BOMBS OR SHELLS.



SOMEDAY, MAYBE WE COULD TALK EVEN TO
PEOPLE IN OUTER SPACE. IT IS BELIEVED THAT A LASER BEAM, PROJECTED
FROM EARTH, COULD STILL BE DETECTED AT 100 LIGHT YEARS DISTANCE.

NOW, LET'S GET BACK
TO OUR HISTORY LESSON
ON ELECTRONICS...



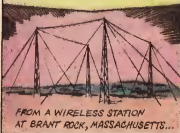
ON DECEMBER 12, 1901, GUGLIELMO MARCONI SENT THE FIRST TRANS-ATLANTIC WIRELESS MESSAGE FROM ENGLAND TO ST. JOHN'S, NEWFOUNDLAND. IT MARKED THE BEGINNING OF LONG-RANGE RADIO COMMUNICATION.



SEVERAL YEARS LATER, SHIPS WERE ADDING A SMALL ROOM TO THE TOP DECK TO HOUSE MARCONI'S WIRELESS RADIO SETS. THIS ROOM WAS CALLED THE "RADIO SHACK" BY SAILORS.



A CANADIAN-AMERICAN INVENTOR, REGINALD FESSENDEN, MADE HISTORY ON CHRISTMAS EVE, 1906, WHEN HE SENT THE FIRST VOICE AND MUSIC BY "WIRELESS" (RADIO)



FROM A WIRELESS STATION
AT BRANT ROCK, MASSACHUSETTS...



...HEARD BY MANY AMAZED
WIRELESS OPERATORS ABOARD SHIPS
AT SEA HUNDREDS OF MILES AWAY,

BOB, WHAT REVOLUTIONIZED ELECTRONICS A FEW YEARS AFTER MARCONI'S SUCCESSFUL TRANS-ATLANTIC RADIO TEST?

IT WAS THE DE FORREST "AUDION" RADIO TUBE IN 1915. IT MADE POSSIBLE LOUDER SOUND FROM RADIOS.



RIGHT, BOB! IN A FEW YEARS, RECEIVERS USING AUDION TUBES REVOLUTIONIZED RADIO LISTENING, —MORE STATIONS COULD BE TUNED IN... EVEN THOSE FAR AWAY!



LEE DE FORREST'S INVENTION OF THE AUDION MARKED THE BEGINNING OF REGULAR RADIO BROADCASTS INTO THE HOME.



EARLY-DAY RADIO SETS WERE LARGE, AND THE LOUDSPEAKER LOOKED LIKE THE HORN OF A MUSICAL INSTRUMENT.



SOON, EVEN BETTER RADIO SETS WERE MADE. U.S. ARMY MAJ. EDWIN ARMSTRONG DEVELOPED THE SUPERHETERODYNE RECEIVER DURING WORLD WAR I. IT GAVE THE U.S. AND ITS ALLIES A GREAT ADVANTAGE. HE ALSO DEVELOPED FM RADIO DURING THE LATE 1930'S.

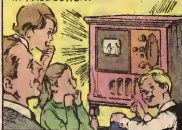
ON JUNE 9, 1922, INVENTOR/EDUCATOR JOSEPH TYKOCINER, (TICK-OK-SHINER), A POLISH IMMIGRANT TO THE U.S., DEMONSTRATED THE FIRST SOUND-ON-FILM MOTION PICTURE... THE PRINCIPLE USED IN OUR MODERN-DAY MOVIES. THE PICTURE SHOWED PROF. ELLERY PAINE RECITING LINCOLN'S FAMOUS "GETTYSBURG ADDRESS."



OTHER FIELDS OF ELECTRONICS BEGAN TO DEVELOP ALSO. IN 1933, KARL JANSKY ANNOUNCED THE DISCOVERY OF RADIO WAVES FROM OUTER SPACE!.. THE BEGINNING OF RADIO ASTRONOMY.



BY 1939, ELECTRONICS WAS A VERY ACTIVE BUSINESS AND INDUSTRIAL FIELD. THERE WERE EVEN SOME SMALL COMMERCIAL TV SETS IN PRODUCTION.



MODERN TV PICTURES CAN BE RECEIVED IN 85 COUNTRIES. NOT ONLY THAT, BUT ELECTRONIC ADVANCES HAVE WIDENED THE SCOPE OF TV GREATLY.



GIANT RADIO TELESCOPES HAVE BEEN BUILT, LIKE THE RADIO ASTRONOMY OBSERVATORY AT GREENBANK, W. VA., TO HELP US LEARN MORE ABOUT OUTER SPACE.

TV DEVELOPED RAPIDLY AFTER WORLD WAR II. ITS PORTABILITY AND ADAPTABILITY TO STRANGE ENVIRONMENT MADE TV A VALUABLE SCIENTIFIC TOOL. ON JULY 20, 1969, IT SHOWED US THE FIRST MEN ON THE MOON.



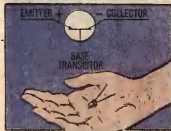
A TELESCOPE SCANNING OUTER SPACE FROM A PLATFORM-IN-ORBIT CAN SEND TV PICTURES OF WHAT IT SEES BACK TO EARTH.

IN THE LATE 1940'S, SCIENTISTS MADE A REVOLUTIONARY DISCOVERY FOR RADIO CIRCUITS. WHAT WAS IT?

I KNOW! IT WAS THE **TRANSISTOR** IN 1948.

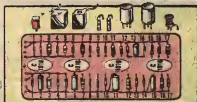


THIS IS THE SYMBOL FOR THE TINY TRANSISTOR... WHICH MADE POSSIBLE SMALL, LIGHTWEIGHT RADIOS.



YES, THE NOBEL PRIZE IN PHYSICS WAS SPLIT BETWEEN THREE AMERICANS... FOR INVENTING THE TRANSISTOR:

JOHN BARDEEN, WILLIAM SHOCKLEY, AND WALTER BRATTAIN. IT REVOLUTIONIZED THE ELECTRONICS INDUSTRY.



ANOTHER GIANT STEP OF THIS EVOLUTION TOWARD MINIATURIZATION WAS THAT OF **PRINTED CIRCUITS**. SOLID-WIRE CONNECTIONS AND TUBES WERE BEING REPLACED BY PRINTED CONNECTIONS ON A FLAT CIRCUIT BOARD.

THIS MAY SEEM HARD TO BELIEVE, BUT IT'S NOW POSSIBLE TO PRINT AS MANY AS 18,000 CIRCUITS ON A ONE-INCH BOARD.

GEEL

JUST HOW SMALL CAN YOU BUILD A CIRCUIT?



THIS IS KNOWN AS **MOLECULAR ELECTRONICS**, WHERE MATERIAL ONLY ONE MILLIONTH OF AN INCH THICK IS USED. SOMEDAY, THIS CIRCUITRY BUILDING WILL BE DONE ENTIRELY BY AN ELECTRONIC BEAM.

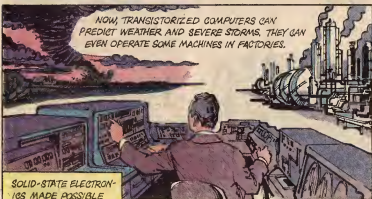
COMPUTER ENGINEERS WERE VERY INTERESTED IN THE TRANSISTOR BECAUSE OF ITS SMALL SIZE AND EFFICIENCY.

Wow!

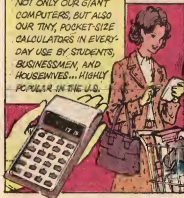


IN 1959, A COMPUTER WAS BUILT WITH 18,800 TUBES. IF IT HAD BEEN BUILT TODAY, IT WOULD HAVE NEEDED ONLY 4000 TRANSISTORS.

NOW, TRANSISTORIZED COMPUTERS CAN PREDICT WEATHER AND SEVERE STORMS. THEY CAN EVEN OPERATE SOME MACHINES IN FACTORIES.



SOLID-STATE ELECTRONICS MADE POSSIBLE NOT ONLY OUR GIANT COMPUTERS, BUT ALSO OUR TINY, POCKET-SIZE CALCULATORS IN EVERYDAY USE BY STUDENTS, BUSINESSMEN, AND HOUSEWIVES... HIGHLY POPULAR IN THE U.S.



AND NOW, THERE'S EVEN A TINY COMBINATION CALCULATOR-AND-WATCH ABOUT THE SIZE OF A REGULAR WRISTWATCH.

TODAY, MICROCOMPUTER SYSTEMS COSTING AS LITTLE AS A CONSOLE TV SET ARE FINDING USES IN TEACHING/LEARNING...



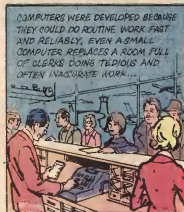
...IN REDUCING TIME AND PAPERWORK FOR SMALL-BUSINESS OPERATIONS...



...AS AN AID IN SCIENTIFIC RESEARCH LABORATORY WORK... TO SPEED TESTING AND DESIGN PROCEDURES...



AS WELL AS USE AT HOME... FOR COMPUTING FAMILY FINANCES AND FOR PLAYING THE NEW TV GAMES.



COMPUTERS WERE DEVELOPED BECAUSE THEY COULD DO ROUTINE WORK FAST AND RELIABLY. EVEN A SMALL COMPUTER REPLACES A ROOM FULL OF CLERKS DOING TEDIOUS AND OFTEN INACCURATE WORK...

...AND BY 1981, A SATELLITE BUSINESS SYSTEMS CRAFT WILL TRANSMIT DATA DIRECTLY TO ROOFTOP ANTENNAS OF U.S. BUSINESS AND GOVERNMENT AGENCIES FROM 22,300 MILES ABOVE EARTH.



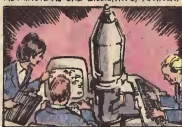
COMPUTERS PLAYED A VITAL ROLE IN HELPING TO LAND THE U.S. LUNAR MODULE "CHALLENGER" AND ITS LUNAR ROVING VEHICLE TO EXPLORE A LARGER AREA OF THE MOON. ANOTHER FIRST FOR THE UNITED STATES!



THE WORLD GREW EVEN SMALLER BY 1972, WHEN PEOPLE AROUND THE WORLD WERE ABLE TO VIEW LIVE TELECASTS OF THE U.S. PRESIDENT'S VISIT TO THE PEOPLE'S REPUBLIC OF CHINA VIA THE U.S.-BUILT INTELSAT III IN ORBIT ABOVE THE EARTH.



...SCIENCE OPENED A WHOLE NEW WORLD FOR MEDICAL SCIENCE WITH ZWORYKIN'S ELECTRON MICROSCOPE. IT VIEWS AN AREA AS MINUTE AS ONE-BILLIONTH OF AN INCH.



COOKING FOODS WITH MICROWAVE OVENS IS GAINING IN POPULARITY. SAVES TIME IN THE KITCHEN!

TELEVISION IMPROVEMENTS SINCE 1960 INCLUDE TELEVISION LENS ZOOMING, INSTANT VIDEO TAPE RECORDING, AND INSTANT "PLAYBACK" OF SPORTS PLAYS.

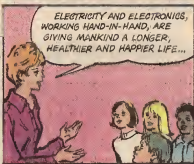


ELECTRONICS ALSO PLAYS AN IMPORTANT ROLE IN AIR SAFETY. A 747 JET CAN LAND OR TAKE OFF IN PITCH DARKNESS, RAIN, SNOW, SLEET OR FOG IN REASONABLE SAFETY.

AUTOMATIC COMPUTER-CONTROLLED "PEOPLE MOVERS" PROVIDE LOCAL TRANSPORTATION AT THE DALLAS-FORT WORTH AIRPORT.



ELECTRICITY AND ELECTRONICS, WORKING HAND-IN-HAND, ARE GIVING MANKIND A LONGER, HEALTHIER AND HAPPIER LIFE...



TELEMEDICINE CLOSED-CIRCUIT TV LETS DOCTOR AND PATIENT SEE AND TALK TO EACH OTHER...

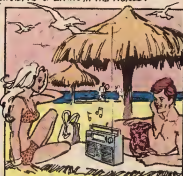


... BY LONG DISTANCE—MAKING A SPECIALIST'S SERVICES AVAILABLE OVER WIDER AREAS OF THE COUNTRY.

TODAY, MILLIONS OF PEOPLE IN OUR COUNTRY, THE UNITED STATES, GET TO ENJOY THE FABULOUS BENEFITS OF ELECTRICAL/ELECTRONIC APPLIANCES AND EQUIPMENT. ...IT HAS GIVEN OUR PEOPLE THE HIGHEST STANDARD OF LIVING IN THE WORLD. ELECTRONICS PROVIDES ENTERTAINMENT, TOO!



MOBILE CB-2-WAY RADIO HELPS TO MAKE TRAVEL HAPPIER AND SAFER...



PORTABLE RADIOS FOR LOCAL AND SHORTWAVE LISTENING PROVIDE MUSIC AND NEWS OF THE DAY...



STEREO HI-FI COMPONENT SYSTEMS BRING US THE "LIFELIKE" SOUND OF MUSIC FOR HAPPY LISTENING!



ELECTRONICS IS A POPULAR HOBBY ACROSS THE COUNTRY. AND IT'S A GREAT WAY TO RELAX!



PORTABLE TAPE RECORDERS MAKE POSSIBLE TAPING SPECIAL MUSICAL EVENTS AND FAMILY GET-TOGETHERS...

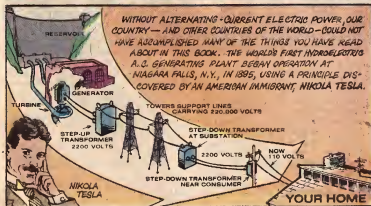


...AND NOW, THERE'S AN "OSCAR" IN ORBIT, THE SATELLITE USED BY HAM RADIO OPERATORS ...PIONEERS IN COMMUNICATIONS IN THE U.S.

TODAY, THE UNITED STATES PRODUCES AND CONSUMES A THIRD OF THE WORLD'S ELECTRIC ENERGY TO GIVE ITS CITIZENS THE BEST STANDARD OF LIVING EVER ACHIEVED BY MANKIND, AND WE MUST CONTINUE TO EXPLORE THE FORCES OF NATURE FOR NEW SOURCES OF ENERGY... SOLAR POWER, COAL, GAS, STEAM FROM GEYSERS, WATER-POWER, NUCLEAR POWER... TO TURN THE TURBINES THAT PRODUCE OUR ELECTRICITY.



SOLAR HEATING PANELS
HARNESS THE SUN'S RAYS
TO PROVIDE ANOTHER
SOURCE OF ENERGY.



TEST YOUR MEMORY!

Write in the names of these
famous inventors from . . .
HISTORY'S HALL OF HONOR®

(answers at bottom of this page)



(answers to Science Quiz)

1. Joseph Henry (Dec. 17, 1797-May 13, 1878)
Engineer-Inventor and First Secretary Smithsonian Institution
2. Samuel F. B. Morse (April 27, 1791-April 2, 1872)
Inventor of the Telegraph
3. Alexander Graham Bell (March 3, 1847-Aug. 2, 1922)
Inventor of the Telephone
4. Charles F. Steinmetz (April 9, 1865-Oct. 26, 1923)
Electrical Engineer and Mathematical Wizard
5. Guglielmo Marconi (Apr. 25, 1874-July 20, 1937)
Inventor of Wireless Telegraphy
6. Nikola Tesla (July 10, 1856-July 7, 1943)
Inventor of AC Motors and Discoverer of the AC Principle of Electric Power Production

7. Vladimir Zworykin (July 30, 1889-)
Inventor of the Scanning Principle used in today's TV Cameras and Receivers
8. Thomas A. Edison (Feb. 11, 1847-Oct. 18, 1931)
Inventor of the Incandescent Lamp (Electric Light bulb)
9. Lee de Forest (Aug. 26, 1873-June 30, 1961)
Inventor of the Amplifying Radio Tube, the "Audion"
10. Karl Guthe Jansky (Oct. 22, 1905-Feb. 14, 1950)
His Discoveries paved the way for today's Radio Astronomy
11. Shared Nobel Prize for their invention of the Transistor
A. John Bardeen (May 23, 1908-) Inventor
B. Walter H. Brattain (Feb. 10, 1902-) Inventor
C. William Shockley (Feb. 13, 1910-) Inventor



CB Monitor Receiver Kit

Listen to truckers, motorists and other CB'ers on all 40 channels. And no FCC license is required. Illustrated board, spring-clip wiring and numbered parts. Requires one 9V battery. 28-238.

Crystal AM Radio Kit



Plays Forever Without Transistors or Tubes

A tiny diode converts the RF signal to audio using circuitry similar to that which Marconi used in the early 1900's. Covers 550 kHz 1600 kHz AM band. With earphone. Easy solderless assembly. 28-207.

Science Fair® Radios

AM/FM Radio Kit



Deluxe circuitry contains 4 transistors and a transformer, pre-assembled FM tuner section, illustrated manual and numbered parts for simplified assembly with spring-clip connectors. With earphone. Requires 2 "AA" batteries. 28-234.



For Listening Excitement

AM Radio Broadcasting Kit



Broadcast to any standard AM radio — up to 40' away! Includes microphones, transmitter, tuning control and antenna wire. Requires one 9V battery. 28-209.



Police/ Aircraft Monitor Kit

Monitor police frequency and hear news as it happens. Listen to jumbo jets in flight. Tunes 108-135 and 147-174 MHz. Safe, solderless spring clip connectors. Requires one 9V battery. 28-221.

Solar-Powered AM Radio Kit



**Solar Panel Included —
Converts Light to Electricity**

Solar panel converts sunlight — or any bright light — to electricity that powers this radio. Or you can use any 9V battery. Tunes the entire 550-1600 kHz AM band. With earphone. No batteries needed. 28-214.

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